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AOYAMA & PARTNERS

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April 5, 2005

**Via Facsimile &
CONFIRMATION BY DHL**

Our file reference: 664543

**Re: Transmittal of Written Reply to the Written Opinion of
International Application No. PCT/JP2004/008934**

**Applicants: SUMITOMO CHEMICAL COMPANY, LIMITED
HITACHI, LTD.**

Dear Sirs:

In response to the written opinion mailed on October 19, 2004

On behalf of the applicants, we hereby submit the following reply to the written opinion which was established by the International Searching Authority under Rule 43bis.1 and shall, under Rule 66.1bis(a) but subject to Rule 66.1bis(b), be considered to be a written opinion of the International Preliminary Examining Authority for the purposes of Rule 66.2(a).

AMENDMENTS UNDER RULE 66.3

We wish to amend the claims as per enclosed replacement sheets (pages 57 to 59) replacing pages 57 to 59, in which claim 1 has been amended by deleting the general formula (Z-7) and its substituent R¹¹. Please substitute these replacing pages for pages 57 to 59 as originally filed.

REPLY TO THE OPINION

1. DOCUMENTS

The following documents are referred in this communication:

D1: GB 2 338 240 A (15 December 1999)

D2: US 5 851 427 A (22 December 1998)

D3: US 5 904 984 A (18 May, 1999)

D4: US 5 569 727 A (29 October 1996)

D5: Barashkov N. et al.: "Design of New Polymers to Improve Radiation Stability of Plastic Scintillators" Proceedings of the Fourth International Conference on CALORIMETRY IN HIGH ENERGY PHYSICS, 19-25 September 1993, pages 542-551, XP009037802 SINGAPORE

2. NOVELTY

D1 discloses a polymerizable composition comprising epoxy compounds of formula III (See, claim 4 in D1).

On the other hand, the present invention directs to an epoxy composition which comprises an epoxy compound of formula (1) as defined in any one of claims 1 to 3. When the epoxy compound of formula (1) has (Z-7) as Z, -O- as Y¹ and Y², A-3 as Ar¹ and Ar², said epoxy compound overlaps with the epoxy compound of formula III disclosed in D1 (wherein m is 1, rings are 1,4-phenylene groups, and Z¹ and Z² are -OCH₂- and -CH₂O-, respectively).

In order to avoid the above overlapping, the applicants have deleted the formula (Z-7) from options for a group Z in claim 1 by submitting amendments to amend claim 1. Simultaneously, the applicants have also deleted a substituent R¹¹ for the formula (Z-7).

In addition, it is clear that any one of D2, D3, D4 and D5 does not disclose an epoxy compound which includes epoxy compound of formula (1) of the present invention.

Therefore, the present invention has novelty.

3. INVENTIVE STEP

The epoxy compound of the present invention is a novel compound, which can be converted into a cured epoxy resin product having liquid crystal properties as well as good heat conductivity. Therefore, the cured epoxy resin product of the present invention is useful as an insulating material requiring high heat releasability such as a printed circuit substrate and the like (See, page 4, lines 6 to 13, and

page 47, line 14 to page 54, line 6 of WO 2004/113327 A1 published on 29 December 2004).

D1 discloses a polymerizable composition comprising components a) ~ f), in which the component c) comprises at least one mesogenic compound having two or more terminal polymerizable epoxy groups (See, page 1, lines 4 to 28, page 4, line 15 to page 6, line 31). It is considered that the object of the invention disclosed in D1 is to provide polymerizable compositions that are suitable for the preparation of anisotropic polymer films which exhibit a high flexibility, shown strong adhesion to other films and substrate and, can act as their own adhesive (See, page 2, line 35 to page 3, line 3). However, D1 fails to disclose or teach a liquid crystalline epoxy compound having good thermal conductivity and therefore useful as an insulating material.

D2 discloses photocross-linkable liquid crystalline compound comprising a naphthyl group and cross-linkable groups at both ends, wherein the cross-linkable group is generally recognized in the art (See, column 2, line 53 to column 3, line 43). It is considered that the object of the invention disclosed in D2 is to provide compounds having excellent thermal stability and long-term stability in the cross-linked state, and thus being outstandingly suitable for optical components (See, column 2, lines 9 to 17 and lines 57 to 59). However, D2 fails to disclose or teach a liquid crystalline epoxy compound having good thermal conductivity and therefore useful as an insulating material.

D3 discloses liquid crystal thermoset epoxy resins (LCTs) comprising a mesogen and epoxy groups at both ends (See, column 2, line 30 to column 5, line 19). It is considered that the object of the invention disclosed in D3 is to provide a LCT having superior electrical and mechanical properties compared to other epoxy resins and thus being useful as electrical insulation (See, column 2, line 22 to 29). However, D3 fails to disclose or teach a liquid crystalline epoxy compound having good thermal conductivity and therefore useful as an insulating material.

D4 discloses anisotropic polymers of liquid crystalline diepoxide A and liquid crystalline diisocyanate B, wherein the liquid crystalline diepoxide comprising an aromatic ring, a heteroaromatic ring or a cycloaliphatic trans-1,4-cyclohexylene group in the middle (the middle group Z) and epoxy groups at both ends (See, column 1, line 50 to

column 3, line 9). Additionally, the diepoxide A and the diisocyanate B are reacted by heating to form an anisotropic polymer (See, claim 5). Therefore, the liquid crystalline diepoxide A is not used alone in this invention. Moreover, D4 fails to disclose or teach a liquid crystalline epoxy compound having good thermal conductivity and therefore useful as an insulating material.

D5 discloses a new polymer to improve radiation stability of plastic scintillators. In addition, D5 describes that the highest light yield was obtained from the diglycidylether of bisphenol-A (DER 332) as an epoxy resin, PTP as primary dopant, and a diglycidyl derivative of quarterphenyl and diphenylanthracene as secondary dopants. However, D5 fails to disclose or teach a liquid crystalline epoxy compound having good thermal conductivity and therefore useful as an insulating material.

Further, neither D2-D5 nor D1 contains any explicit or suggestive disclosure to motivate the combination of D2-D5 and D1.

In conclusion, the present invention is not disclosed nor suggested by the cited documents D1-D5 and, thus, the present invention has an inventive step over D1-D5.

4. OTHERS

Although D1-D5 are not identified in the description nor briefly discussed, the examiner is respectfully requested to proceed in this case with issuing a positive international preliminary examination report.

We would appreciate if you kindly acknowledge receipt of this letter. A copy of this letter is enclosed herewith for an acknowledgement.

Sincerely yours,

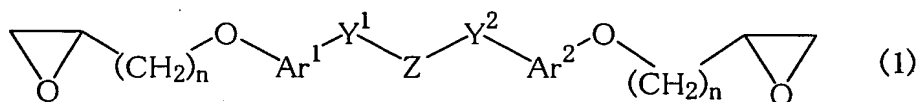
AOYAMA & PARTNERS

Masaki Yano

MY/TS/ny
Enclosure (3 pages)

CLAIMS

1. An epoxy compound of formula (1):

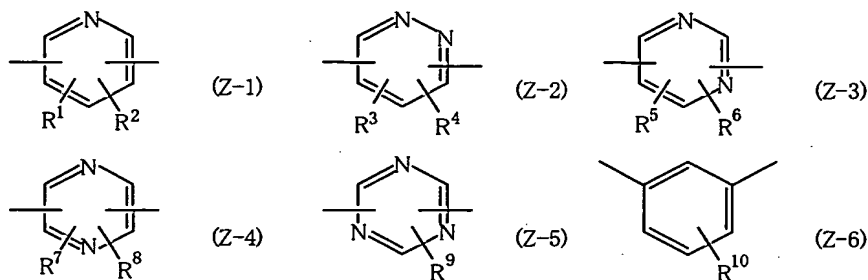


wherein n represents an

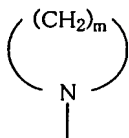
5 integer of 1 to 9,

the $-(CH_2)_n-$ group may have inserted $-O-$, or $-N(R')-$, between the methylene groups, wherein R' represents a hydrogen atom or a C_{1-18} alkyl group,

10 Z represents any one of divalent groups of the following general formulas (Z-1) to (Z-6):

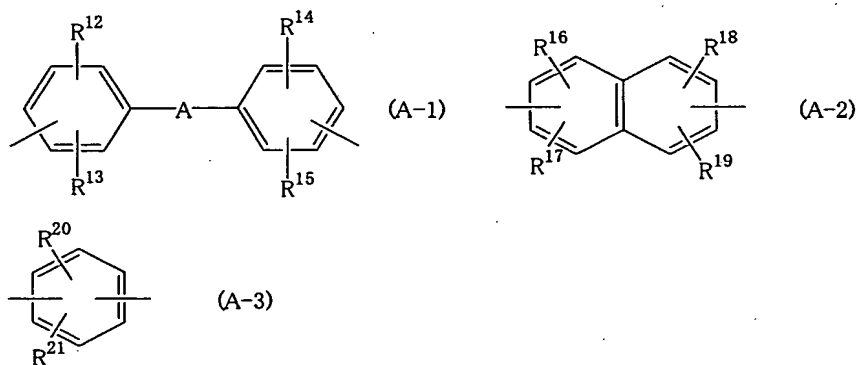


15 wherein $R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9$ and R^{10} are the same or different and represent independently a hydrogen atom, a C_{1-18} alkyl group, an amino group substituted with one or two C_{1-18} alkyl groups, or a cyclic amino group of the following formula:

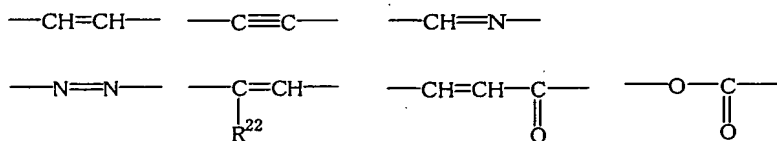


wherein m represents an integer of 4 to 12, and one methylene group or two or more not neighboring methylene groups of the C₁₋₁₈ alkyl group or groups as defined in connection with R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹ or R¹⁰, and
 5 of the cyclic amino group, may be replaced with -O-, -NH-, -N(R'')- or -S-, wherein R'' represents a C₁₋₁₈ alkyl group,

Ar¹ and Ar² are the same or different and represent any one of groups of the following formulas (A-1) to (A-3):



10 wherein A represents a single bond or any one group selected from the group consisting of:

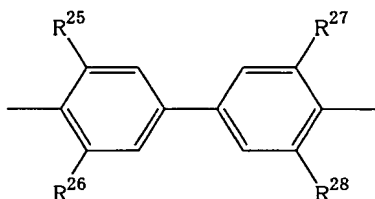


wherein R¹², R¹³, R¹⁴, R¹⁵, R¹⁶, R¹⁷, R¹⁸, R¹⁹, R²⁰, R²¹ and R²² are the same or different and represent independently a
 15 hydrogen atom, a halogen atom, a C₁₋₁₈ alkyl group, a C₁₋₈ alkoxy group, a cyano group, or a nitro group,

Y¹ and Y² are the same or different and represent a single bond, -O-, -S-, or -Si(R²³)(R²⁴)-, wherein R²³ and R²⁴

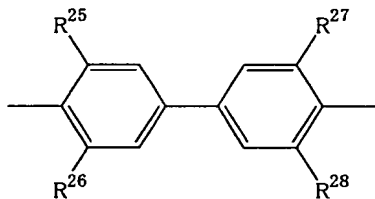
are the same or different and represent independently a lower alkyl group or a phenyl group.

2. The epoxy compound according to claim 1, wherein Ar¹ and Ar² in formula (1) are the same or different and represent independently a group of the following formula:



wherein R²⁵, R²⁶, R²⁷ and R²⁸ are the same or different and represent independently a hydrogen atom or a methyl group.

3. The epoxy compound according to claim 1, wherein Ar¹ and Ar² in formula (1) represent the same group of the following formula:



wherein R²⁵, R²⁶, R²⁷ and R²⁸ are the same or different and represent independently a hydrogen atom or a methyl group.

4. An epoxy composition, which comprises the epoxy compound as defined in any one of claims 1 to 3 and a curing agent.